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Professor Carey B. Joynt
Lehigh University
Bethlehem, Pennsylvania

Dear Professor Joynt:

It is very gratifying to hear that my papers have been useful to you with your classes. I am delighted to know that you found them suggestive. As for the Hitler papers, I am afraid that they have been awaiting editing and revision for several years now, although there are some reasons to think they may get some attention in the next few months. My manuscript copies are really too marked up at this point to be very intelligible, but I will certainly send you a copy when I have something suitable for distribution.

I'm looking forward to seeing your paper on risk problems. I don't remember whether I sent you a reprint of my paper on risk and ambiguity, but I'm enclosing one now, anyway. As I may have mentioned, I spent roughly the last six months writing a dissertation on this problem of decision-making under conditions of extreme uncertainty; I could send you a copy if this is close to your present interests (it is too bulky -- 400 pages -- to press on anyone who isn't almost obsessed by the subject).

One point of substance may be of interest, since it is relevant to the papers you have seen. You will have noticed the emphasis in both the bargaining and the strategy papers on the notion of a "critical risk," a decision-threshold determined by the structure of payoffs. In my more recent work in decision theory, I have been considering problems related to the vagueness, or "fuzziness" or "ambiguity" of subjective probabilities. One way to represent such a state of mind is to say (as I. J. Good does) that the person does not assign a single, precise probability to a given event, but rather a roughly-defined interval of probabilities; he is able to say "definitely" that a given event E is more probable than another event to which he can assign the definite probability, say, .3, and less probable than another event to which he can assign the definite probability, say, .7, but he cannot make such definite comparisons between E and events whose probabilities lie within that interval. Another way to say this is that the person does not assign a single, definite probability distribution over all events, but is able to reject a number of

distributions as contradictory to his definite opinions; he is left with a set of distributions, all of which are consistent with his definite opinions. From either point of view, he can assert definitely inequalities among the probabilities of various events, though he cannot assign unique, definite probability number to every event. (This is closely related to the views of J. M. Keynes, B. O. Koopman, and I. J. Good.)

The question arises, "How does he reach reasonable decisions when his opinions are this 'vague'?" Suppose that he feels able to say definitely that he considers the probability of event E to be greater than .2 (in the sense indicated above), though he cannot assign a definite number. This may be enough to determine his decision, if his critical risk (in either the bargaining or the strategic context) is known, on the basis of his payoffs. In other words, it may be useful to focus on "decision thresholds" precisely because probabilities can often be stated, at best, in terms of inequalities. Of course, to determine the threshold itself, even roughly, it is necessary to estimate the relative payoffs with some precision, which is a significant problem in itself. But those elements which can be estimated relatively precisely -- whether these consist of payoffs, or probabilities, or both -- may sometimes be used to establish threshold values for other decision elements, so that a decision can be determined on the basis of "vague" estimates of these other elements.

I don't know whether such a brief discussion seems intelligible. I have always been uneasy about the assumption that a person could assign definite probabilities to events; I see now that the "critical risk" notion is a device designed expressly to make that assumption unnecessary.

Yours,

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